We claim:

- 1 1. A machine readable medium that provides instructions, which when executed by a
- 2 set of processors, cause said set of processors to perform operations comprising:
- 3 receiving an Ethernet frame; and
- 4 transmitting the Ethernet frame over a non-homogenous tunnel, the tunnel
- 5 distinguishing subscriber traffic.
- 1 2. The machine readable medium of claim 1 further comprising transmitting
- 2 requested values over the non-homogenous tunnel.
- 1 3. The machine readable medium of claim 1 wherein the Ethernet frame is
- 2 transmitted on one of the plurality of sessions.
- 1 4. A machine readable medium that provides instructions, which when executed by a
- 2 set of processors, cause said set of processors to perform operations comprising:
- transmitting a set of Ethernet data included in an Ethernet frame with Layer 2
- 4 Tunneling Protocol (L2TP); and
- 5 transmitting the set of Ethernet data to a service provider.
- 1 5. The machine readable medium of claim 4 further comprising the service provider
- 2 analyzing the set of Ethernet data.
- 1 6. The machine readable medium of claim 4 wherein the set of Ethernet data is
- 2 transmitted over a non-homogenous L2TP tunnel.
- 1 7. The machine readable medium of claim 4 wherein the transmitting the set of
- 2 Ethernet data comprises encapsulating the Ethernet frame with L2TP.

- 1 8. The machine readable medium of claim 7 wherein the encapsulating the Ethernet
- 2 frame comprises:
- establishing an L2TP tunnel capable of carrying the Ethernet frame;
- 4 establishing an L2TP session for carrying the Ethernet frame; and
- 5 prepending L2TP headers onto the Ethernet frame.
- 9. A machine readable medium that provides instructions, which when executed by a
- 2 set of processors, cause said set of processors to perform operations comprising:
- encapsulating an Ethernet frame in Layer 2 Tunneling Protocol (L2TP); and
- 4 transmitting the L2TP encapsulated Ethernet frame over a network; and
- 5 decapsulating the Ethernet frame from L2TP.
- 1 10. The machine readable medium of claim 9 wherein the L2TP encapsulated
- 2 Ethernet frame is transmitted on one of a plurality of sessions of a non-homogenous
- 3 tunnel.
- 1 11. The machine readable medium of claim 9 wherein transmitting the Ethernet frame
- 2 further comprises transmitting attribute value pairs (AVPs) in relation to the Ethernet
- 3 frame.
- 1 12. The machine readable medium of claim 9 wherein transmitting the frame
- 2 comprises:
- 3 establishing an Ethernet capable L2TP tunnel; and
- 4 establishing an L2TP session to carry the frame; and
- 5 transmitting a MAC address.

- 1 13. The machine readable medium of claim 9 further comprising performing session
- 2 fail retry.
- 1 14. A machine readable medium that provides instructions, which when executed by a
- set of processors, cause said set of processors to perform operations comprising:
- 3 establishing a Layer 2 Tunneling Protocol (L2TP) tunnel capable of carrying an
- 4 Ethernet frame;
- 5 establishing an L2TP session to carry the Ethernet frame;
- transmitting the Ethernet frame in L2TP encapsulation over the L2TP session; and
- 7 decapsulating the frame.
- 1 15. The machine readable medium of claim 14 wherein the L2TP tunnel is non-
- 2 homogenous.
- 1 16. The machine readable medium of claim 14 wherein establishing the L2TP session
- 2 comprises performing session fail retry.
- 1 17. The machine readable medium of claim 14 wherein establishing the L2TP tunnel
- 2 capable of carrying the Ethernet frame comprises transmitting an L2TP control message
- 3 indicating a tunnel capable of carrying the Ethernet frame.
- 1 18. The machine readable medium of claim 14 further comprising performing session
- 2 fail retry.
- 1 19. A machine readable medium that provides instructions, which when executed by a
- 2 set of processors, cause said set of processors to perform operations comprising:

3	transmitting a first tunnel control message for Layer 2 Tunneling Protocol (L2TP)
4	tunnel setup having
5	an attribute value pair (AVP) indicating Ethernet frame capability,
6	receiving a second tunnel control message for L2TP tunnel setup having
7	an AVP indicating Ethernet frame capability;
8	transmitting a session control message having an AVP indicating an L2TP
9	Ethernet session and an AVP indicating an Ethernet Media Access Control
10	(MAC) address; and
11	transmitting an Ethernet frame with the L2TP Ethernet session.
1	20. The machine readable medium of claim 19 further comprising performing session
2	fail retry before transmitting the Ethernet frame.
1	21. The machine readable medium of claim 19 wherein transmitting the first and
2	second tunnel control messages comprises manipulating the bits of the first and second
3	tunnel control messages.
1	22. A machine readable medium that provides instructions, which when executed by a
2	set of processors, cause said set of processors to perform operations comprising:
3	establishing an Ethernet capable Layer 2 Tunneling Protocol (L2TP) tunnel;
4	accepting an L2TP session;
5	receiving an L2TP encapsulated Ethernet frame over the session;
6	decapsulating the Ethernet frame; and
7	associating the Ethernet frame to a virtual circuit structure.

- 23. The machine readable medium of claim 22 wherein the tunnel is non-
- 2 homogenous.

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1	24.	The machine readable medium of claim 22 wherein establishing the Ethernet
2	capab	e L2TP tunnel comprises:
3		receiving a first tunnel control message indicating Ethernet capability; and
4		transmitting a second tunnel control message indicating Ethernet frame capability.
1	25.	The machine readable medium of claim 22 wherein accepting the L2TP session
2	compr	ises:
3		receiving a session control message indicating session type and an Ethernet MAC
4		address; and
5		creating a virtual circuit structure in response to the control message.
1	26.	The machine readable medium of claim 22 further comprising extracting a set of
2	data fr	om the Ethernet frame.
1	27.	The machine readable medium of claim 22 wherein the associating the Ethernet
2	frame	to the virtual circuit structure comprises processing the Ethernet frame as indicated
3	by the	virtual circuit structure.
1	28.	A machine readable medium that provides instructions, which when executed by a
2	set of	processors, cause said set of processors to perform operations comprising:
3		receiving a first Layer 2 Tunneling Protocol tunnel control message having an
4		attribute value pair (AVP) indicating Ethernet capability;
5		transmitting a second L2TP tunnel control message having an AVP indicating

Ethernet capability;

7		receiving a session control message having an AVP indicating a session type and
8		an Ethernet MAC address;
9		creating a virtual circuit structure for the session type in response to the session
10		control message; and
11		processing an L2TP packet having a payload with the virtual circuit structure.
1	29.	The machine readable medium of claim 28 wherein processing the L2TP packet
2	comp	rises:
3		decapsulating the payload from the L2TP packet; and
4		processing the payload as indicated by the virtual circuit structure.
1	30.	The machine readable medium of claim 28 wherein the first and second control
2	messa	ages include values requested by a customer.
1	31.	An apparatus comprising:
2		a Layer 2 Tunneling Protocol (L2TP) Access Concentrator (LAC) to transmit an
3		Ethernet frame over an L2TP tunnel; and
4		an Layer 2 Tunneling Protocol Network Server (LNS) to receive the Ethernet
5		frame from the L2TP tunnel originating at the LAC.
1	32.	The machine readable medium of claim 31 wherein the L2TP tunnel is non-
2	homo	genous.
1	33.	The apparatus of claim 31 wherein the LAC to transmit the Ethernet frame
2	comp	rises:
3		establishing an L2TP tunnel capable of carrying an Ethernet over L2TP session;
4		and

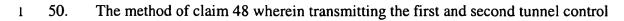
5 establishing ar	Ethernet over l	L2TP session	to the LNS.
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1	34.	The apparatus of claim 33 wherein establishing an L2TP tunnel capable of
2	carryi	ng an Ethernet over L2TP session comprises:
3		the LAC transmitting a first tunnel control message to the LNS indicating
4		Ethernet frame capability; and
5		the LNS transmitting a second tunnel control message to the LAC indicating
6		Ethernet frame capability.
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- 1 35. The apparatus of claim 33 wherein the establishing the Ethernet over L2TP
- 2 session to the LNS comprises the LAC transmitting to the LNS a session control message
- 3 indicating Ethernet encapsulation and an Ethernet Media Access Control (MAC) address
- 4 for the LAC.
- 1 36. A Layer 2 Tunneling Protocol (L2TP) Access Concentrator (LAC) comprising:
- an operating system to establish an Ethernet capable L2TP tunnel with a peer,
- 3 to perform session fail retry;
- 4 to establish an Ethernet over L2TP session in the tunnel,
- to encapsulate an Ethernet frame with L2TP; and
- 6 a circuit to transmit the session.
- 1 37. The LAC of claim 36 wherein to establish the Ethernet over L2TP session
- 2 comprises transmitting signals, the signals including requested values.
- 1 38. The LAC of claim 36 wherein the tunnel is non-homogenous.

1	39.	The LAC of claim 36 wherein to establish the Ethernet capable L2TP tunnel
2	comp	rises:
3		transmitting a first tunnel control message indicating Ethernet frame capability;
4		and
5		receiving a second tunnel control message indicating Ethernet frame capability.
1	40.	The LAC of claim 36 wherein to establish the Ethernet over L2TP session in the
2	tunne	el comprises transmitting a session control message indicating Ethernet
3	encap	osulation and an Ethernet MAC address for the LAC.
1	41.	A Layer 2 Tunneling Protocol (L2TP) Network Server (LNS) comprising:
2		an operating system to establish an Ethernet capable L2TP tunnel;
3		a circuit to receive an Ethernet over L2TP packet having an Ethernet frame as a
4		payload; and
5		a logic to process the packet.
	;	
1	42.	The LNS of claim 41 wherein the tunnel is non-homogenous.
1	43.	The LNS of claim 41 wherein the operating system to establish the Ethernet
2	capat	ble L2TP tunnel comprises:
3		receiving a first tunnel control message indicating Ethernet capability; and
4		transmitting a second tunnel control message indicating Ethernet capability.
1	44.	The LNS of claim 41 wherein the logic to process the packet comprises:
2		decapsulating the payload from L2TP encapsulation;
3		associating the payload with a virtual circuit structure; and
4		processing the payload as indicated by the virtual circuit structure.

1	45.	A computer implemented method comprising:
2		receiving an Ethernet frame; and
3		transmitting the Ethernet frame over a non-homogenous tunnel, the tunnel having
4		a plurality of sessions.
1	46.	The method of claim 45 further comprising transmitting requested values over the
2	non-h	omogenous tunnel.
1	47.	The method of claim 45 wherein the Ethernet frame is transmitted on one of the
2	plural	ity of sessions.
1	48.	A computer implemented method comprising:
2		transmitting a first tunnel control message for Layer 2 Tunneling Protocol (L2TP)
3		tunnel setup having
4		an attribute value pair (AVP) indicating Ethernet frame capability,
5		receiving a second tunnel control message for L2TP tunnel setup having
6		an AVP indicating Ethernet frame capability;
7		transmitting a session control message having an AVP indicating an L2TP
8		Ethernet session and an Ethernet Media Access Control (MAC) address;
9		and
10		transmitting an Ethernet frame with the L2TP Ethernet session.
1	49.	The method of claim 48 further comprising performing AAA retry before
2	transr	nitting the Ethernet frame.



- 2 messages comprises manipulating the bits of the first and second tunnel control
- 3 messages.